

REMARKS

Applicants acknowledge receipt of an Office Action dated March 10, 2005. In this response Applicants have amended the specification, have amended claims 1, 3, and 4, and have added new claims 5-10. Following entry of these amendments, claims 1-10 are pending in the application.

Reconsideration of the present application is respectfully requested in view of the foregoing amendments and the remarks which follow.

Drawing Objection

On page 2 of the Office Action, the PTO has objected to Figure 1 as not being labeled as "PRIOR ART." Applicants have not characterized Figure 1 as prior art in the disclosure of the application. Applicants state that Figure 1 shows a step and terrace structure of an annealed wafer surface and is not a figure of the prior art. Withdrawal of this objection is respectfully requested.

Claim Objections

On page 2 of the Office Action, the PTO has objected to claims 3 and 4 as reciting the density of the ozonated water being 10 to 60 ppm and the density of the hydrofluoric acid, being 0.5-2%. Per the PTO's suggestion, claims 3 and 4 have been amended to recite "concentration". Withdrawal of the objection is respectfully requested.

Rejections Under 35 U.S.C. § 102

On page 3 of the Office Action, the PTO has rejected claims 1-4 under 35 U.S.C. §102(b) as being anticipated by Japanese Patent 10-256211. This rejection is respectfully traversed.

The cleaning method of claim 1 requires the steps of oxidizing a silicon wafer with ozonized water; cleaning the oxidized silicon wafer with hydrofluoric acid; and oxidizing the silicon wafer with ozonized water. Oxidizing the silicon wafer with ozonized water after the step of cleaning with hydrofluoric acid assures uniform oxidization without relying on crystal orientation, thus maintaining the wafer surface structure more stably. As a result, a micro

roughness at a spatial frequency of $20/\mu\text{m}$ is $0.3 - 1.5 \text{ nm}^3$ in terms of power spectrum density is observed. In other words, the cleaning process produces a silicon wafer with a micro roughness that is maintained from annealing the wafer, and wherein the step and terrace structure of the wafer is not impaired.

JP '211 discloses a method of cleaning a substrate with ozonized water and then hydrofluoric acid for removing particles, metallic pollution, molecular organic pollutions or the like on a semiconductor substrate. (See JP '211; claim 5 and paragraphs [0007] and [0027]). JP '211 also teaches that the cleaning steps of washing with ozonized water and then hydrofluoric acid may be repeated. (See JP '211; paragraph [0013]). That is, in the cleaning method of JP '211, the final cleaning step is a cleaning step with hydrofluoric acid. If the cleaning steps of JP '211 are repeated, then an additional step of washing with hydrofluoric acid is performed. Because the final cleaning step of JP '211 is performed with hydrofluoric acid, wafers cleaned by the process of JP '211 are in the state in which the oxidized film is removed, resulting in a higher surface roughness. Therefore, because JP '211 teaches a cleaning method that results in a silicon wafer of high surface roughness, the cleaning method of JP '211 does not inherently possess the properties required by claim 1. Withdrawal of the rejection is respectfully requested.

Rejections Under 35 U.S.C. § 102

On page 4 of the Office Action, the PTO has rejected claims 1-4 under 35 U.S.C. §102(e) as being anticipated by U.S. Patent Publication 2004/0127032 to Peng et al. (hereinafter "Peng"). This rejection is respectfully traversed.

The washing method disclosed in Peng includes cleaning with ozone or HF, rinsing with hydrogen water or DIW (deionized water) and again cleaning with ozone or the like for removing metallic and organic ions and particles. This process is different from the cleaning method required by claim 1. The cleaning process of Peng will not provide a silicon wafer with a micro roughness that is maintained from an annealing step, wherein the step and terrace structure is not impaired by the cleaning step, as the present invention does. As noted in Applicants' specification, if the wafer is cleaned with pure water or the like before an oxidation treatment process with ozonized water, the wafer is oxidized unequally and the wafer is made rough. (See Applicants' specification; page 9, lines 19-23; page 19, lines 4-

16). The step of rinsing with hydrogen water or deionized water taught by Peng would materially affect a basic and novel characteristic of the claimed invention by increasing the roughness of the cleaned wafer. Furthermore, because the cleaning process of Peng results in a wafer of high surface roughness, the cleaning method of Peng does not inherently possess the properties required by claim 1. Withdrawal of the rejection is respectfully requested.

New claims 5-10

Applicants note that new claim 5-10 are distinguished from JP '211 and Peng for the reasons noted above.

CONCLUSION

In view of the foregoing amendments and remarks, Applicants respectfully submit that all of the pending claims are now in condition for allowance. An early notice to this effect is earnestly solicited. If there are any questions regarding the application, the Examiner is invited to contact the undersigned at the number below.

Respectfully submitted,

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The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicants hereby petition for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.